BROOKES UNIVERSITY

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Understanding Traumatic Brain Injury patient Rehabilitation through the user-centred design of a Mobile Application

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Traumatic Brain Injury

Traumatic brain injury (TBI) is an injury to the brain caused by trauma to the head such as from a road traffic accident, fall or assault. TBI is a major health problem worldwide, with 5.5 million people living with a disability for TBI in the USA and Europe alone [1]. The process of rehabilitation for a patient is long and expensive either for patient or public health provider [2].

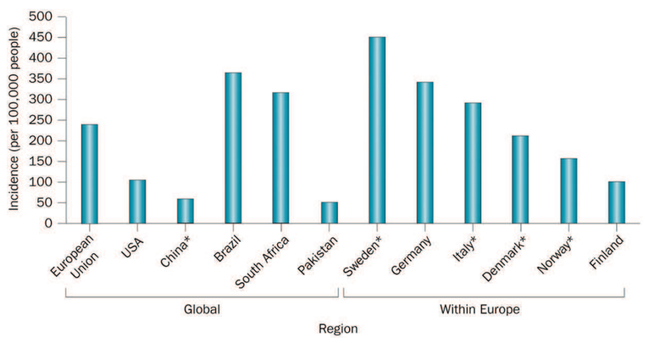

Figure 1 Estimates of the global incidence of traumatic brain injury [3].

This project aims to reduce the burden on medical professionals and costs to patients and health services by gathering quantitative data from patients about their rehabilitation progression through the use of a mobile application, from which medical professionals can perform objective analysis. This is an alternative approach to patient self-reporting to medical professionals.

A trial is underway involving users selected from the Headway Oxford centre, Headway is a charity which specialises in supporting people with brain injury.

Figure 2 Headway is the UK-wide charity that works to improve life after brain injury

User–Centred Design

User-centred Design (UCD) was first introduced by Norman and Draper in 1986 [4] and refers to how end-users influence the design of an application through their involvement in the design process. It has been shown to increase the acceptability and success of applications [5].

Key principles associated with UCD [6] include:

i. A clear understanding of users and their needs;
ii. User involvement in the design process;
iii. User centred evaluation of the application being developed;
iv. An Iterative design process

For this project, users are involved at every stage of the design and development, in order to properly assess the usability of the application, users are taking part in a usability study – influenced by existing methods.

v. Inclusion of inter-disciplinary skills within the team;
vi. Addressing the whole user experience.

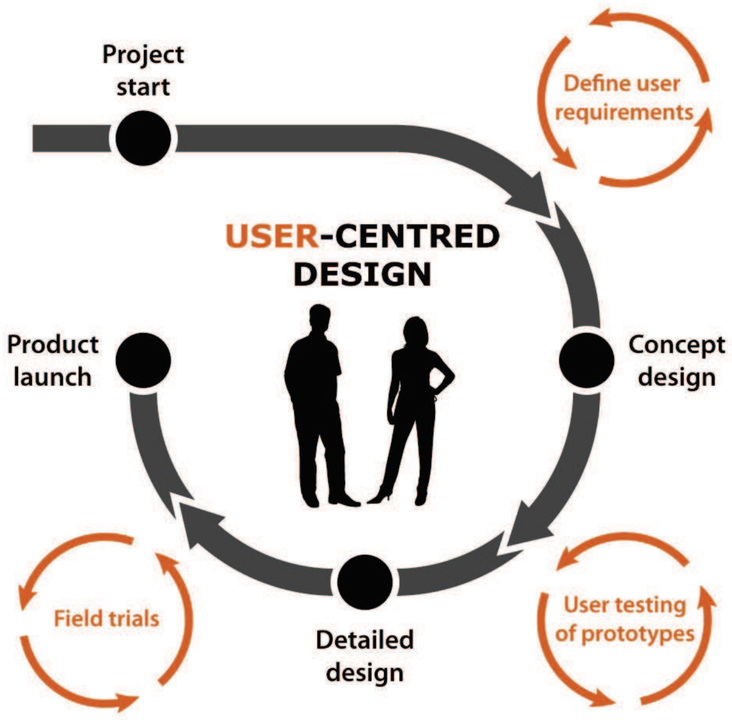

Figure 3 User-centred design is an iterative process which focuses on extensive user involvement in each stage of the development lifecycle from design through to implementation [7].

User Experience Prototyping

After research into traumatic brain injury patient usability requirements and visiting patients to learn more about their experiences using mobile devices the first stage of development was to create a prototype. Simple usability tests were then carried out using this prototype to uncover any major usability issues. The results of the tests then influenced a second iteration of the design.

The prototype was developed using the web-based software InVision.

It allowed testing on the device prior to the implementation, i.e. before writing a single line of code, thus speeding up the design process.

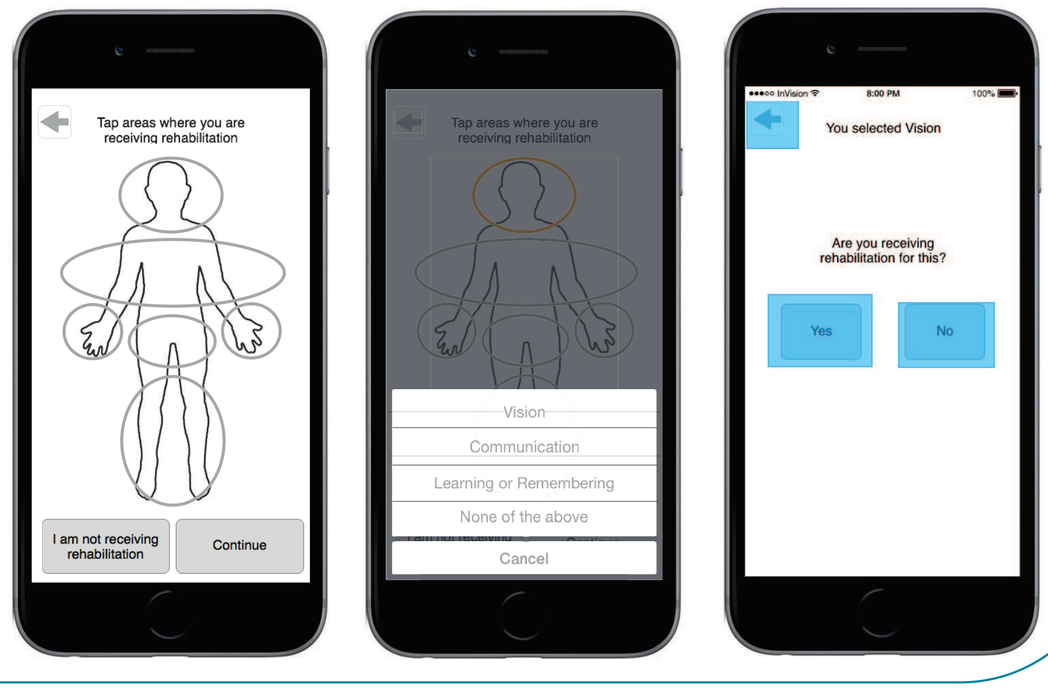

Figure 4 Three example screens from the InVision prototype shown on the iPhone 6, the rightmost image shows clickable/tappable areas highlighted.

Usability Testing

The goal of usability testing is to test whether the product is usable by the intended user population it was designed for and the purposes it was designed for.

We evaluate factors such as efficiency, effectiveness and simplicity by using testing techniques such as the 'Think Aloud' method and data logging [6, 8].

Using the software Lookback, we study users as they attempt to perform a task in our application. The touches and gestures that the user performs are recorded by the tool including where they appear on the screen. This produces quantitative data such as number of operations and time taken to complete a task.

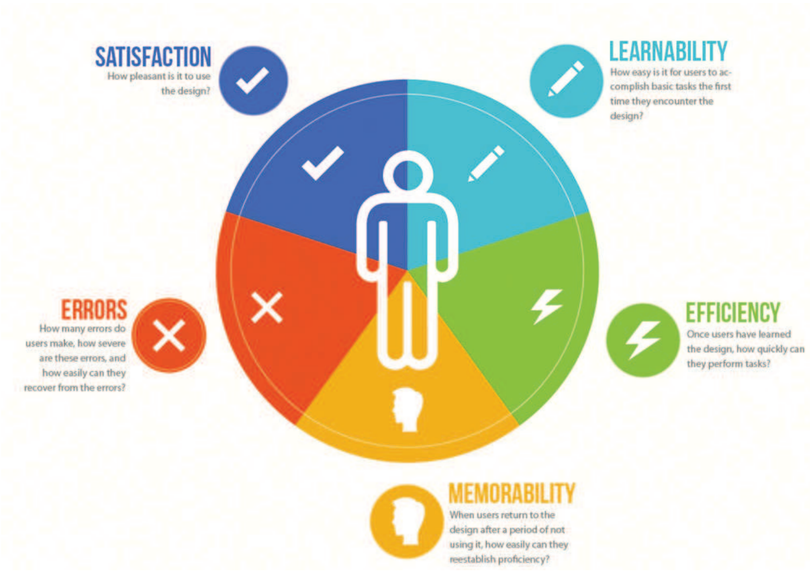

Figure 5 Five key components that determine the usability of an application [9].

Benefits of Research and Future Work

This study will help us to further our understanding of the specific mobile usability requirements of TBI patients. The prototype in development will provide clinicians with a valuable tool to track the rehabilitation progress that TBI patients are making after their injury. It will reduce the burden on health professionals by supplementing their knowledge and providing real data about their patients without the need for a formal meeting. It will also reduce the displacement of patients by allowing them to report their progress remotely via a mobile application rather than having to visit their clinician.

Once the study is completed the data collected will be analysed by researchers at the Faculty of Health and Life Sciences and this application will pave the way for further patient research in this area. Furthermore the information gathered about how best to design and develop mobile applications for patients with traumatic brain injury will have widespread applications for patients with other disabilities and allow further work in this area.

References

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